THE

YOUNG MECHANIC.

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NATURAL PHILOSOPHY.

[Continued from page 7.]

ATTRACTION OF GRAVITATION.

Gravitation is that force with which bodies tend towards the centre of the earth, or by which they fall perpendicularly to its surface.

ILLUSTRATION. Gravitation seems to differ from corpuscular attraction, only as a part differs from a whole: the attractive power which singly unites the particles of smaller bodies, may form that gravitating power, in the aggregate, which governs the system of the universe; thus, considering the attractive influence of bodies as proportional to their magnitudes, the less will be governed by the greater, and those which are on, or near, the surface of the earth, will tend towards its centre. Bodies not only gravitate towards the earth, but likewise towards great elevations or mountains on different parts of its surface; for if a ball be suspended by a line, and placed on different sides of a high mountain, it will gravitate on every side towards the mountain.

The power of gravity gives the same velocity to all bodies; therefore, taking away the resistance of the air, or the medium through which they fall, the descent of all bodies from the same height will be performed in the same time, whether they be great or small, light or heavy.

ILLUSTRATION. If a piece of gold and a feather, or any other bodies, the specific gravities of which are different, be dropped from a given height, through the atmosphere, the superior gravity of the gold will more effectually evercome the resistance of the air, than the inferior weight of the feather, and consequently it will fall much sooner to the ground; but if they both fall at the same instant, from the slip or dropper of an exhausted receiver, they will arrive at the bottom in equal times; for as the resisting medium of the air is here taken away, the bodies descend with equal velocities.

Falling bodies gravitate with an increasing velocity as they approach the surface of the earth.

Illustration. This accelerated motion is produced by the constant power of gravity, which, by adding a fresh impulse at every instant, gives an additional velocity and an increasing motion in every moment of time. The space through which a body falls by the power of gravity in the latitude of London, is 16 1-12 feet, in the first second of time, four times that distance in two seconds, eight times in three seconds, and sixteen times in four seconds; increasing in velocity according to the squares of the distance through which the body descends.

The law of acceleration in bodies descending perpendicularly, holds equally in point of time with those bodies that are projected.

Illustration. If a stone be dropped from the top of a tower, and another of the same weight be thrown horizontally at the same instant, the two different bodies will reach the ground at the same moment of time. Even if a ball were fired with any force horizontally from a cannon, on the top of a tower, it would describe the line of its course in the same time that another ball would fall perpendicularly from the top to the bottom, supposing them to meet with no resistance from the air.

If a ball be dropped from the topmast of a ship, even supposing the vessel to sail through the water with a velocity of ten miles an hour, it will fall exactly at the bottom of the mast.

Illustration. Let A C be the ship's mast, and its position when the ball is dropped from A; C D the distance sailed during the time of the descent; and B D the second situation, when the ball strikes the deck. Then the force, or projecting velocity of the vessel, C D=A B carries it towards B, and the force of gravity acts from A towards C; but the compound force carries the ball to D, in the direction A D, and in the same time that it would fall from A to C, if the vessel were at rest. And as the velocity of the ball and vessel are equal, it apparently drops perpendicularly down the side of the mast, as it describes the curve of projection; but a person in a vessel at anchor, at some distance, would observe its curvilinear direction.

The power of gravitation is greatest at the surface of the earth, and decreases both upwards and downwards, but in a different proportion.

Illustration. In ascending, the gravity decreases as the squares of the distance from the centre increase; for at the distance of the earth's semi-diameter from its surface, the gravity is not more than a fourth of that power on its surface. The force of gravity downwards from the earth's surface, is in a direct ratio as the distance from the centre; for at half the semi-diameter from its centre, the power of gravity is only equal to half the power at the surface; at a quarter, one fourth; and so on for any given distance in like proportion.

CHEMISTRY.

[Continued from page 9.]

CALORIC.

CALORIC is the matter producing heat, not heat itself; thus, when we put the hand near any warm substance, we feel a particular sensation. That sensation is termed heat or warmth; it is supposed to be caused by caloric which is thrown off, or passes from the warmer substance, and enters the hand; and by its action upon it, produces this sensation. Cold is merely a negative quality, signifying only the absence or dimunution of caloric; thus, when we feel the sensation of coldness, caloric passes from us into surrounding substances, and the more rapidly it passes, the more exquisite the sensation.

Though caloric is the matter producing heat, yet it can exist under certain circumstances, in such a state as to lose this property; it is then called combined caloric, sometimes latent heat. These terms both mean the same thing; i. e. that state of that principle which under ordinary circumstances, will affect the thermometer—will produce the sension of heat—will burn—is fire. They mean that state of this principle when it has lost this property. *Combined* caloric, therefore, may be said to be that state of caloric when it will not excite the sensation of heat, or affect the thermometer. *Free* caloric, that state of the same, when it will excite the sensation of heat and affect the thermometer.

Caloric is supposed to exist in this state of combination, in union with all material substances; in the largest quantities, in aeriform bodies—substances in mechanical properties like the common air; next to these in liquids, and least in solids. This being the case we should of course infer that if we took any substance in an *aeriform* state, and changed it from that state to that of a *liquid*, or a liquid into that of a solid, that a portion of this caloric would be given out and become free, or that there would be an increase of temperature. Or if we took a solid substance, and changed it into a liquid, or a liquid into an aeriform body; that a portion of it would be absorbed, and that (other circumstances being equal) there would be a *decrease* of temperature; which is the case as we shall see by reference to experiments hereafter.

4. That it does exist in this state, and that it can be brought from this to that of free caloric—from that state in which it will not excite the sensation of heat, nor affect the thermometer to that state in which it will do both, may be seen by reference to some experiments.

If what has been said is correct, it of course exists in this state in common air; and that it does exist in this state, and that it can be brought from this to a free state, simply by compression, may be seen by means of what is called a fire syringe. A metallic tube, made tight at one end, the other end left open; into this is inserted a piston, which plays perfectly air tight; upon the end of

this piston is a small quantity of tinder; which may be prepared by wetting cotton wool in a strong solution of nitrate of potash (common salt petre) and afterwards thoroughly drying it, or what answers equally well, a small piece of phosphorus wrapped in cotton wool. By forcibly pressing this piston down, the tinder will be inflamed. The reason is this; here the air is very much compressed; the air which filled the whole of the tube being compressed into a very small space at the bottom, it is of course rendered more dense; more nearly resembles a solid, than it did before being compressed; in consequence of this, less caloric is needed in this state of combination; a part of it is pressed out and becomes free, and when free, it produces the same effect as caloric radiated from combustion; i. e. it inflames the tinder.

5. That it exists in liquids, in this state, and that it can be brought to a free state upon the same principle, may be shown by mixing liquids which have a strong attraction for each other.

Illustration. Take two wine glasses, *one* half filled with water, the *other* with oil of vitrol, both *cold;* mix the liquids, and the temperature will immediately rise to nearly or quite the boiling point. All the caloric, however, which thus raises the temperature, existed in the liquids before they were mixed in a state of combination; but when mixed, in consequence of their great attraction for each other, they become more dense, and a portion is pressed out and becomes free.

That they do become more dense, may be known by the fact that they occupy a less space after being mixed than before: i. e. take any two measures, one of oil of vitriol and the other water, say a glass of each, mix them and they will not make *twice* as much; i. e. a *gill.*

6. The same principle holds good when liquids are changed into solids, and *vice versa.*

Illustration. Put water on unslaked lime, and much heat will be given out, as the lime undergoes the process of slaking.

Here, a portion of the water becomes solid, and gives out its combined caloric.

That the water does become solid, may be ascertained by weighing the lime, *before* and *after* slaking, not allowing anything to come in contact with it, but the water, and yet it will be found to increase in weight during the process; as all we have after it is slaked, is perfectly dry and solid; and as it weighs more than before, it of course shows that a portion of the water must have become solid.

7. When solids become liquids, and when liquids become aeriform bodies, there is (owing to the same principle) a decrease of temperature. For, as it requires a larger quantity of caloric, in this state of combination, to keep any substance in a *liquid* state than it does to allow it to exist in a solid state; and also to keep any substance in a gaseous or aeriform state than in that of a liquid, whenever these changes take place, caloric is taken from

surrounding bodies unites with them, and loses the property of exciting the sensation of heat, and of course in the vicinity the temperature is lowered.

Illustration. Mix snow and salt in a small vessel, and stir the mixture with a thin, small vial, having in it a small quantity of water; while the *solid* snow and salt are melting the water in the vial will *freeze;* illustrating the fact, that when solids become liquids, there is a decrease of temperature.

Illustration ii. Put on the bulb of a large air thermometer, a small quantity of sulphuric ether, boiling hot. (The ether may be heated by warming a wine glass and turning the ether into it.) Although the ether is thus hot, it will produce the same effect on the thermometer as ice; for in consequence of the rapid evaporation, i. e. the change from the liquid to the aeriform state; much caloric must unite with it, and lose the property of exciting the sensation of heat.

The air thermometer may be made by taking a bolthead, having a long, slim neck; warm it a little, and place the end of it in a decanter, partly filled with any colored liquid; as it cools the liquid will rise in the neck. It is on this principle, that sprinkling the floor of a room in hot weather, or wrapping bottles of wine or cider with a wet cloth, will tend to decrease the temperature. Also the paradoxical experiments of freezing persons, by turning boiling hot ether upon them, keeping them in a hot place.

As has already been stated, we must examine the substances in this class, by noticing the effect which they produce upon other substances, as they cannot be confined and submitted to the usual method of examination. We may, therefore, in the next place, refer to some of the effects which caloric produces upon other substances; and first may be illustrated this fact.

8. More caloric is required to cause any liquid to boil, when the surface of such liquid is exposed to the pressure of the air, than if this pressure, or any part of it, is removed.

Illustration. Fill a Florence flask one third full of water. Fit a sound cork to the mouth of it, so that it will make it perfectly tight, leaving the stopper out, place the flask over a spirit lamp and allow it to boil. Then remove the heat and *immediately* make the mouth of it tight. Then by turning cold water, or putting ice upon the outside, it will cause the liquid in the vessel to boil rapidly.

The reason is this, when the water boiled in the first place, a part of it was converted into vapor, its volume being increased, it drove out the atmospheric air which filled the upper part of the vessel, so that when the cork was inserted, the upper part of the vessel was filled with the vapor of water. Cooling this condenses it, brings it back to the state of water again, and causes it to occupy a less space; but as the mouth of the flask is tight, air cannot come in to press upon the surface of the water, and this is the reason why the water boils at so low a temperature.

OBSERVATIONS ON DRAWING INSTRUMENTS.

Before the student commences the study of the theory and practice of drawing, it is supposed that he has made himself acquainted with the first principles of Plane and Solid Geometry; indeed, if he has not, he can never expect to arrive at any perfection in this useful and pleasant occupation. A knowledge of geometry is one of the prerequisites attending the study of drawing, so much so, that a person cannot be too great an adept in that science before he begins. It is much to be lamented that such a deficiency of knowledge in this respect, prevails among many who profess to be architects and draftsmen, but whose works proclaim their entire ignorance of the subject, being as it were a confused collection of lines, crossing one another in every direction without any meaning, and capable of being understood only by those whose fertile geniuses have produced them. By geometry the draftsman is taught to place every line on his paper in its true proportion to that of which it is the representation, to decide with certainty what will be the appearance and effect of his plan when finished, as well as if the edifice were really existing in the situation in which his imagination has intended it to be placed. Without geometry, the picture is drawn, as it were, by guess—it has no determinate points or lines, or any other guide than the judgment of the eye. The effect of the whole will be unnatural and disagreeable, tending to mislead the workman, and to deceive him into errors for which he cannot account. It is not necessay that the architect should possess a knowledge of this science alone, although he may have the soundest judgment and the most extensive experience, nevertheless it will require a good taste and a good hand to complete and finish the work, for it would be tiresome and endless in many cases to apply the rules of geometry to all the minutiæ, as the leafy capitals of columns, the ornaments in the entablatures, the infinite variety in the folds of drapery, &c.; much more to give them that roundness, softness, and beauty of effect which is requisite to make a good picture. These will not owe much to geometry, but will be principally indebted for their value to the taste and judgment of the draftsman.

ON MATHEMATICAL INSTRUMENTS.

As it is extremely necessary for the student to be made acquainted in the first place with the construction and use of those instruments, by the means of which he is enabled to make a perfect drawing, and to be able to repair them when they may get out of order, it is hoped that by strict attention to what follows, he will so far inform himself, after a little practice, as to surmount any difficulties which may occur in this respect.

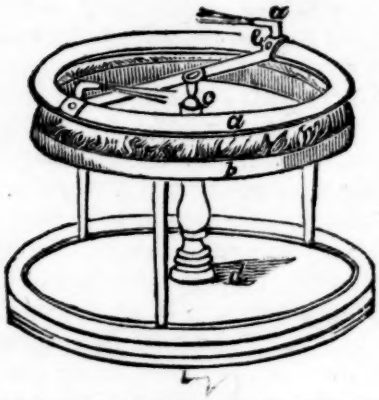
Drawing instruments may be divided into several kinds. First—Those for drawing lines—as pens, pencils, crayons and steel pens. Second—Instruments for guiding or directing the above—

as rulers for drawing straight and slightly curved lines, compasses for drawing circles, trammels and elliptic machines for describing ellipses, and the geometric pen for producing a great variety of curves. Third—Those which are used for marking or setting out distances, or dividing them—as compasses and plane scales, sectors and protractors, also, instruments for dividing circles or elipses.

As it is customary with every artist whose operations are connected with mathematical designing, to furnish himself with a collection of drawing instruments, the best adapted to his particular purposes, they are fitted up in various modes, some containing more, others fewer instruments. What is considered as a complete case, and which is generally the best in use, and such as may be obtained at almost every store, comprises the following articles: a pair of large compasses with shifting leg, an inch point, a pencil point, and one for dotting. Either of these points may be inserted in the compasses instead of the moveable one. A pair of plane compasses, somewhat smaller than the other, for measuring distances; a steel drawing pen, the handle of which unscrews and contains a fine steel point for protracting; a small pair of bow compasses for describing very small circles; a bow pencil for the same purposes; a sector, the use of which will be explained hereafter; a plane scale, which has lines graduated upon it with equal divisions of different values; a protractor or semi-circle, divided into degrees for laying down angles; a parallel rule; a black lead pencil, with a silver ferule on top, formed like the blade of a penknife for scratching out or tracing lines on the paper.

In the best cases of instruments the protractor and plane scale are always combined. Those instruments in general use are seldom more than six inches in length, but often smaller. The former are commonly preferred to any other size; they will effect nearly all that is necessary. There are also larger collections of instruments, called *magazines*, many of which contain a great number, and which are moreover very expensive, and of so very little use, comparatively speaking, that they will hardly compensate the student for purchasing them. These generally contain in addition to those before enumerated—several pieces to lengthen occasionally one leg of the compasses, and thereby enable them to measure greater extents, and describe circles of larger radii; a pair of hair compasses; a pair of triangular compasses; a pair of proportional compasses, either with or without an adjusting screw; a pair of wholes and halves; a knife, file, key and screw driver, all in one piece; a pair of beam compasses; a pair of elliptical do.; a pair of spiral do.; a pair of perspective do.; a pair of compasses with micrometer screw; a centrolinead, or rule for drawing lines tending to a centre at a great distance; one or more rolling parallel rulers, a pentagraph, besides numerous other minor instruments.

(To be continued.)



FIRST STEAM ENGINE.

For a long time the reputation of the first discoverer of the steam engine was accorded to the Marquis of Worcester. But it was afterwards discovered that Branca, an Italian of some celebrity as an author and philosopher, had anticipated the Marquis some years in the application of this power to machinery. This was supposed to be a final settlement of claims in regard to this subject. But quite recently it has been discovered that a new claimant to this distinguished honor, appears in Hiero of Alexandria, who flourished about a century before the commencement of the christian era. And now we shall not be much surprised if finally it should be traced back to Tubal Cain, that cunning antedeluvian worker in metals.

Mr. Partington lately exhibited a model of Hiero's steam engine, made by Mr. Styles, to a London audience, of which the annexed figure is a representation. The upper circumference of the machine, *a*, is filled with water, and supported on the pillar *d*, at the top of which it turns on the pivot *c*. The water being boiled by the flame of alcohol in the trough *b*, the steam issues rapidly from the small apertures as at *e*, and the opposite extremity of the transverse diameter, and the machine continues to revolve on its axis as long as heat be applied, and it contains water. WATT.

THE FIRST SAW MILL.

The old practice in making boards was to split up the logs with wedges; and, inconvenient as this practice was, it was no easy thing to persuade the world that it could be done in any better way. Saw mills were first used in England in the fifteenth century; but so late as 1555 an English ambassador having seen a saw mill in France, thought it a novelty which deserved a particular description.

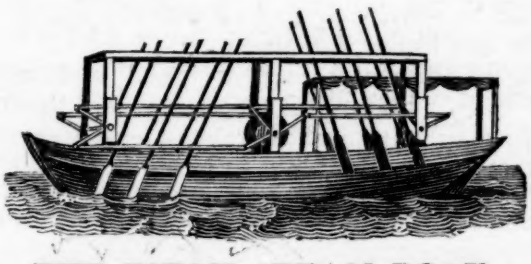
It is amusing how the aversion to labor-saving machinery has always agitated England. The first saw mill was established

by a Dutchman in 1663, but the public outcry against the new fangled machine was so violent, that the proprietor was forced to decamp with more expedition than ever did Dutchman before.

The evil was thus kept out of England for several years, or rather generations; but in 1768 an unlucky timber merchant, hoping that after so long a time the public would be less watchful of its own interests, made a rash attempt to construct another mill. The guardians of the public welfare, however, were on the alert, and a conscientious mob at once collected and pulled the mill to pieces. Such patriotic spirit could not always last, and now, though we have no where seen the fact distinctly stated, there is reason to believe, that saw mills are used in England.—*N. Y. paper.*

One of the conductors of the Young Mechanic visited Portsmouth (Eng.) Dock Yard in 1812. At that time the Block Machinery contrived by Brunel was in operation. The sawing of the large timbers was performed by the steam engine; there were pit saws, cross-cut saws, circular saws, mortising chisels, and a variety of other contrivances for finishing the blocks, all put in operation by steam.

A large steam saw mill has been erected near the city road, on the regent's canal, London. In Westminster, and several other places in and about London, saw mills are in operation, and no doubt in the manufacturing districts.



THE FITCH STEAM BOAT.

We have procured the engraving of an early Steam Boat, the contrivance of John Fitch, clockmaker of Philadelphia. Several experiments were made on the Delaware at Kensington in 1788. The machinery was constantly getting out of order. A few friends who had patronized him grew disheartened, and he was obliged to relinquish the undertaking. This was twenty years before Fulton made his successful experiment on the Hudson. Fitch's boat was propelled by twelve oars; six of them came out of the water, while the other six entered the water. The cylinder of the engine lay in a horizontal position. The piston rod was attached to suitable levers, axle, &c. Fitch retained full confidence that the scheme was a feasible one to the end of his life. He observed to some friends who listened to him without faith, 'Well, gentlemen,

although I shall never live to see the time, you will, when steam boats will be preferred to all other means of conveyance, especially for passengers; and particularly on the Mississippi.' He then retired; when one exclaimed with deep sympathy, 'Poor fellow! what a pity he is crazy.'

From the 'Industriel,' and Gill's Technical Repository.

ON TINNING CAST-IRON WEIGHTS.

These are first to be well rubbed and cleansed in a bath of sulphuric acid, (*oil of vitriol*) which has been diluted with a proper quantity of water. After this preparation, they are to be dipped into water, in which sal-ammoniac has been dissolved, in the proportion of one-seventeenth of the salt, to the quantity of water employed. During these operations, we melt fine and pure tin, with which has been previously mixed copper, in the proportion of three ounces of this latter metal to one hundred pounds of the tin. When the mixture has been melted at a proper degree of heat, not so high, however, as to hinder it from attaching itself to the pieces of cast-iron to be tinned, they may be plunged into it.

The weights should be previously turned into shape, in the lathe, and be made smooth before tinning them; and when they have become cold, after the tinning process, they may be polished in the lathe by means of burnishers in the usual manner.

In order to render the three ounces of copper easily fusible in the tin, it should be previously melted with six pounds of that metal, taken from the one hundred pounds.

This tinning of the weights is designed, not only to preserve their size and weight better, but also to prevent them from rusting; and we can thus substitute these cheap cast-iron weights, in the room of the more expensive ones of brass or copper.

THE PERPETUAL MOTION A PERPETUAL NOTION.

Mechanics seem to be as far from solving the question relative to a perpetual motion as they were two thousand years ago; and yet many of them are still troubled with the old mania. No reasoning will deter them from the pursuit. I suppose the reason why those that know better do not endeavor to stop this kind of speculation is, that they think as Bishop Wilkins did two hundred years ago, when he compared them to the man who dug the vineyard for a hid treasure, and, although he did not find it, yet made the ground more fruitful. Working at models of this kind is certainly a very expensive and tedious way of studying the science of mechanics. Reading and attending lectures with experiments are much better. The Academy of Sciences in Paris have resolved that they will have nothing to do with pretended discoveries of a

perpetual motion; they have decided that the invention is impossible, and that all attempts at the discovery of it are a mere waste of time. The quadrature of the circle, and the trisection of an angle are also, in their opinion, problems impossible of solution. There is a wide difference between a perpetual motion and a self-mover. The former moves perpetually, and may be any human contrivance put in motion by the ebbing and flowing of the tides, the waters of a never failing cataract, variations of the atmospheric pressure, expansion and contraction of metals and other bodies; in fact, any motion that the great Author of nature has made, will, if we can hook our machine to it, serve this purpose. But the latter, a self-mover, show me one. I will enclose it in a box, and ask this question, does this machine move without the aid of any cause beyond the limits of this box, and yet, after it has moved for a definite length of time, appear as likely to continue as it did at first? There are only two kinds of motion with which we are acquainted—mechanical and chemical. In all mechanical contrivances, there is a loss of power. It is a general rule to make allowances for friction in the steam engine; and it is common to allow one-third of the power of the steam for the friction of the engine. One pound of power applied to any machine whatever, will not raise a pound weight through as much space as itself descended. Motion occasioned by chemical action must come to a stand; for the materials acted upon are continually undergoing decomposition, or are altered in such a manner that they do not return to their former state, and in the same place. In illustration of this, take the steam engine for an example. The fuel of the fire is acted on chemically, and is decomposed, and no art can return it to its former state. So of the water in the boiler; although the steam will return to the state of water, yet some of it will be decomposed and form an oxide on the sides of the heated metal. Another portion will escape beyond our reach. Gun-powder is a source of great power, but the materials of its composition are dissolved in one discharge. For fear of being tedious, I will conclude with a brief quotation from Mr. Banks: 'When a man tells me he can construct a water-wheel in such a manner, that when once put in motion it shall raise water to keep itself moving —or that he has constructed a pump in such a manner that one man may do the work of ten; I pay the same attention to him as if he told me he could create a system of worlds, and command them to move.'

PHILO.

IMPORTANCE OF TRIFLES.

It is a fact that some curious arts cannot be transported but by the workman himself. Most men will learn better by seeing the operation, than by reading or any other method. This is illustrated in the following statement of a glass trinket maker of

Birmingham, England, and is in substance as follows: 'Eighteen years ago, on my first journey to London, a respectable man asked me if I could supply him with doll's eyes; and I was foolish enough to feel half offended; I thought it beneath my dignity to make doll's eyes. He took me into a large room, and from the immense number of legs, arms and trunks, I was convinced he wanted a great quantity of eyes. He gave me an order amounting to upwards of £500. On my return, although I had some of the very best workmen in the glass-toy line, yet, they shook their heads, said they had seen the article before, but could not make it. I offered them great inducements to try their best, and after wasting much time the project was abandoned. Within a few months, however, I turned my attention again to the doll's eyes, determined to make them, if possible. After a while I met by accident a poor fellow, in poverty from drinking, and dying of a consumption. I showed him ten sovereigns; he said he would instruct me in the process. He could not bear the smell of his own lamp, and though I was well acquainted with such work, I felt that it could not be done from his description. He took me into his garret, and before I had seen him make three I felt competent to make a gross; and the difference between his mode and that of my workmen was so trifling that I was astonished.' TRIFLE.

JAMES BRINDLEY.

THIS celebrated engineer was entirely self-taught in even the rudiments of mechanical science, and to the end of his life was barely able to read, or write except to sign his own name.

He was born in Derbyshire, in 1716. His father having wasted his property, young Brindley was obliged to labor almost from his infancy. At the age of seventeen, he bound himself apprentice to Mr. Bennet, a millwright at Macclesfield. Here the superiority of his genius unfolded itself. In a short time the millers placed more confidence in his opinions than in those of his master, and such was his devotion to his business, that for the purpose of obtaining correct information about a paper-mill, he visited a mill at the distance of fifty miles, between Saturday evening and Monday morning; this being the only time he could spare.

His reputation continued to increase until he attained the age of forty. It was at this period that the duke of Bridgewater required his assistance for his projected canal. Here his genius found its proper field, in planning and executing that great work. He however accomplished all the parts of his undertaking in a manner, not only satisfactory to his employer, but with such display of talent that succeeding engineers have constantly referred to his works as models for imitation. The strength of his genius is made the more apparent when it is considered, that his profession, more than most others, requires mathematical learning.

When any great effort of his mind was required, it was his custom to retire to bed, where he remained until his task of invention was accomplished, which sometimes lasted two or three days; when he would get up and put his design at once into execution. One of the difficulties Brindley had to encounter, was to carry a canal over the river Irwell, without interfering with its navigation. But nothing could dismay him. Thinking, however, prudent to give his employer the best evidence in his power of the practicability of his design, he requested that another engineer should be called in to give his opinion. This person being carried to the spot, Brindley explained to him how he meant to carry on the work. But the man only shook his head, and remarked, that 'he had often heard of castles in the air, but never before was shown where any of them were to be erected.' The duke, nevertheless, retained his confidence in his own engineer. The work proceeded, an aqueduct was erected over the river supported by three arches, on which a vessel might be frequently seen passing along, while another, with all its masts and sails standing, was holding its undisturbed way directly under its keel. Alluding to the Hare-castle tunnel a writer observes, 'Gentlemen, come to view our eighth wonder of the world, the subterranean navigation, which is cutting by the great Mr. Brindley, who handles rocks as easily as you would plum-pies, and makes the four elements subservient to his will. He is as plain a looking man as one of our boors of the Peak, or one of his carters, but when he speaks all ears listen, and every mind is filled with wonder at the things he pronounces to be practicable.' This man's total want of education left his genius without any other field to exercise itself and spend its strength than that which the pursuit of his profession afforded it. Its power, even here, would not probably have been impaired if it could have sought relaxation in variety; on the contrary, its spring would most likely have been all the stronger for being occasionally unbent. Mr. Brindley died at the age of fifty-six years.

HINT ON PRESERVING THE SOLES OF BOOTS.

My boots being damp the other day, I placed them on the top of an iron stove, with the intention of their remaining a few seconds only. Being suddenly called away on other business, I forgot my boots. When I returned they were pretty well roasted. Being afraid they were spoiled, I applied lamp oil to the burnt part until it would receive no more. This was to keep them from cracking. Since that time they have been more impervious to moisture, very hard, and I have no doubt will wear the longer for it. I have been told by a first rate bootmaker that linseed oil would have been better. This hint may be improved by others.

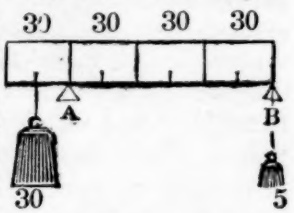
ECONOMY.

ANSWERS.

We have received several answers to the question concerning the stick of timber, and have selected the following. The others are not correct.

In answer to this question I would say, the hand spike must be placed at one-fourth the length of the stick from the end, which is six feet three inches.

The explanation is as follows: Divide the stick into four equal parts, as in the annexed figure. Supposing the whole weight to be 120 pounds, each part will be thirty pounds. The hand spike is placed at A, and the man at the extremity B. Now, if we suppose that part of the stick to the left of A to be removed, there will remain 90 pounds to be supported equally by A and B, and 45 pounds by each. We will now estimate the effect of that part on the left of A. This is done on the principle of the lever or weighing balance. The weight of this part, or 30 pounds, is concentrated in the middle of the part, or where there is represented a weight of 30 pounds hanging. The effect of 30 pounds at this point would be to support 5 pounds at B; because the distance from the fulcrum at A to B, is six times as great as the distance from the fulcrum to where the 30 pounds weight hang. By this operation, the load on B is reduced to 40 pounds, or one-third the weight of the stick. It follows from this, that, in addition to 45 pounds and 30 pounds, this 5 pounds taken from B must be added to A, which will make the load on A 80 pounds, or two-thirds the weight of the stick.



FORE PLANE.

Messrs Editors—In answer to the inquiry of U. M., respecting the pond or river, which never freezes, I would observe, that I was as ignorant of the cause as himself, until within a few months past, when I saw the following reason given in the second part of Arnott's Physics. 'Water, exposed to a keen frost, will not harden on the surface, like the ground; but the surface, which is the part exposed, will be cooled, and descend, from its being in a denser, or heavier state, and will force up the warmer water, to take its place; this in its turn is cooled and descends, and a continued circulation is established, so that the surface cannot become ice, until the whole mass, of whatever depth, is cooled down to its greatest density. Hence, the very deep sea is not frozen in the coldest climates, and in the temperate climates the severest winters do not freeze even a deep lake.' Therefore this pond, or river, in the state of Maine, is probably so deep, that the whole mass does not become cooled to the freezing point, before it is checked by the return of spring. I hope that this explanation will solve the mystery in the mind of U. M. as it has in my own. J. M. W.

QUESTIONS.

Messrs Editors—I wish to inquire through the medium of your Magazine whether some method cannot be adopted for killing neat cattle different from the one in common practice. Surely it would seem to a reflecting mind, that some other plan might be pursued contrary to that of knocking out their brains, or that which is nearly as barbarous. I

think any person who has seen one of these useful animals knocked on the head, as they frequently are, a number of times before they can be brought to the floor, and hears the moans of the poor animal, must be convinced of the barbarity of the practice. I have frequently spoken to butchers on this subject, but have always received for answer, that no better method could be substituted. But their saying so does not prove it. Almost every branch of mechanical business has been improved within a few years, and I do not see any good reason why there cannot be improvements in this. The subject cannot be called an insignificant one, when we take into consideration the great number of cattle killed in the course of a year, merely in the vicinity of Boston. In one slaughter-house alone there are killed in the fall of the year, from sixty to eighty head a day. Now my idea of this matter is, that if the patient, the ever toiling ox, is to be slaughtered, it should be done by occasioning as little pain as possible. I hope that some of your enlightened correspondents will consider the subject worthy of attention, and communicate their thoughts through your useful periodical, and much oblige a friend to humanity. BRIEF.

WHAT method could be adopted in a grist-mill, so that the miller should take neither more nor less than his proper toll; let the quantity of grain be what it may?

THREE seamen sat down to a frugal meal. A had 3 biscuits, B 4, and C 5. D came up at the time, and these four men partook equally of said biscuits. D put down six cents for what he eat. How should the money be divided?

MESSRS EDITORS—I should be pleased if some of your correspondents, would inform me through the pages of the Young Mechanic, the cause of several horses being killed by lightning last summer, while the persons remained unhurt in the carriages to which the horses were attached.

PHILO.

Required, the best method of managing an apprentice to a mechanical trade, so as to give mutual satisfaction; the lad to have a chance to improve his mind, appear respectable, and when free to own one hundred dollars? A MASTER MECHANIC.

NOTICE TO INVENTORS.

BY a recent regulation in the patent office, no letters patent will be issued without the specification is accompanied by a good model of the invention for which an exclusive property is solicited.

STATE LYCEUM.

THE annual meeting of the State Lyceum was held at the State House on Thursday evening, Feb. 2. Extracts from highly interesting reports from the various county and town Lyceums were read; and several gentlemen addressed the meeting in behalf of the Lyceum system of education. The meeting was adjourned to Monday evening, when it was addressed by Mr. Woodbridge on the National Lyceum and by Mr. Calhoun on the subject of common schools. The following preamble and resolution important to young mechanics were unanimously adopted:

'Whereas in the opinion of this meeting, many of our enterprizing mechanics, for want of scientific knowledge, suitable books, and proper advice, frequently incur an expense of time and money to very little profit, in endeavoring to perfect useful inventions, which might have been avoided, in part at least, by timely application to some person competent to judge of their merits; and whereas it is believed to be in the power of this Lyceum to do something towards removing this evil; therefore,

'RESOLVED, That this Lyceum adopt measures to remedy this defect, by appointing one or more committees of advice, procuring a place of deposit, inviting inventors to send in their plans, models, &c.—and by such other means as may be deemed expedient and practicable, to endeavor to promote the object.'

This resolution was unanimously adopted after some discussion, and referred to the Curators to be carried into effect, in such manner as they may deem expedient.

TABLE OF MECHANICAL MOVEMENTS.

MR. S. N. DICKINSON published some time since, one of these tables. We think this table with the explanations, peculiarly adapted to persons engaged in the construction of machinery. Certainly very few, if any, of our mechanics are in possession of a library that contains near so many useful diagrams. If this sheet were put up in a convenient place in a work shop, or counting room, or even a lecture room, many persons would become familiar with various combinations of wheels, levers &c. the existence of which were before unknown to them.

A NEW STEAM ENGINE.—A patent has been obtained for a new steam engine, in Philadelphia. It entirely dispenses, not only with the lever beam, but nearly all the valves, rods and wheels, that render the ordinary machinery of steam engines so complex. The movements are remarkably perfect and easy, and make but little noise.

NEW LIGHT.—We called last evening at the Congress Hall, (Wells's Hotel) to see in operation a newly constructed Lamp, by which a clear, beautiful light is given without the aid of wicks, or rather without the hindrance of wicks. Common oil is placed in the bowl of the lamp, and is made to produce gas for the light. The construction is simple, and it is said the consumption of oil is 50 per cent. less than in the usual mode of lighting rooms. The lamp is worthy the attention of the curious.—*U. S. Phil. Gaz.*

TO CORRESPONDENTS.

'AN Essay on the claims of the Mechanic Arts, and the causes of their slow progress,' is very acceptable: also 'Patents of Massachusetts granted in January, February, March and April, 1831.'

The conductors are in want of articles on a number of subjects not yet treated upon. They request those who have articles prepared on any subjects adapted to this work, to send them in as early as convenient.

An abstract of the proceedings of the late convention of farmers, mechanic, and other working men, held in this city, will probably appear in our next.